from the imperfections of the lunar tables, which appear to give the moon's longitude at the time of the eclipse at least 1 too much: the error in latitude at the same time is almost insensible.

---

## No. XLII.

*Observations of the eclipse of the sun, June 16th, 1806: made at the Forest, near Natchez.—Latitude 31° 27′ 48″ N. and supposed Longitude about* $6^h$ *5′ 25″ to 40″, W. of Greenwich, by William Dunbar Esq.*

Read August 15th, 1806.

IN these observations, an excellent clock with a gridiron pendulum was used, made by J. Bullock of London; a portable chronometer served occasionally as a companion to the clock, which last was frequently regulated and corrected, by equal altitudes of the sun, taken by a circle of reflection.

☽ April 28th, 1806, astronomical time. With a six-feet Gregorian reflecting telescope, power 100, observed an occultation of e leonis by the moon, as follows:

☽ e ♌ Immersion at $8^h$ 49′ $10\frac{1}{2}$″, per clock. The emersion was not seen; the star was at some distance from the moon's limb, before it was noticed, which was ascribed to the extreme brightness of the moon, then nearly on the meridian.

The following new and short formula was used, for finding the equation of equal altitudes, viz. To the logarithmic cosine of the latitude, add the sine of the half-interval, in degrees, and the arith. comp. of the cosine (or secant) of the altitude; the sum, rejecting tens from the index, is the sine of an angle: take out the corresponding cotangent, to which add the arith. comp. of the cosine (or secant) of the sun's declination, and the logarithm of the declination, gained or lost during the half-interval, reduced to seconds of time; the sum, rejecting tens from the index, is the logarithm of the correction or equation of equal altitudes, in seconds of time; additive when the sun is receding from the elevated pole, and vice versa.

*Note*, when the index in the last result turns out to be 8 or 9, which can happen only when the sun is very near the solstices, the equation must then be considered as a fraction.

May 1st. Equal altitudes of the sun's lower limb.

| | A. M. | Double altitude | | P. M. |
|---|---|---|---|---|
| | h ′ ″ | ° ′ ″ | | h ′ ″ |
| At | 8 38 31½ | 82 11 35 | at | 3 20 35½ |
| | 42 42½ | 83 57 30 | | 16 23½ |
| | 50 32¼ | 87 15 42 | | 8 35 |
| | 57 2 | 89 59 10 | | 2 3 |

Contacts of the sun with his image for finding the index error. } Index on 18′ 10″, off 45 30

| | h ′ ″ |
|---|---|
| A mean of the above gives apparent noon uncorrected per clock, at | 11 59 33 22 |
| Equation of equal altitudes. . . . . . . | — 5 63 |
| Apparent noon per clock corrected at. . . . . . | 11 59 27 59 |
| Equation of time. . . . . . . . . . | + 3 3 25 |
| Clock fast for mean time. . . . . . . . | 2 30 84 |

June 2d. Equal altitudes of the sun's lower limb.

| | A. M. | Double altitude | | P. M. | | |
|---|---|---|---|---|---|---|
| | h ′ ″ | ° ′ | | h ′ ″ | | |
| At | 8 36 46 | 88 20 | at | 3 19 29½ | Index on | 18′ 30″ |
| | 41 27½ | 90 20 | | 14 48½ | off | 44 45 |
| | 51 14½ | 94 30 | | 5 2 | | |
| | 53 35 | 95 30 | | 2 41 | | |

By these the clock was too fast for mean time 36″ 4, and by a comparison with those of May the 1st, the clock loses at the rate of 3″ 6 per day, which correction being applied to the occultation of e leonis, we shall have the immersion at $8^h\ 46'\ 30''\ 2$ mean time, or $8^h\ 49'\ 11''\ 37$ apparent time.

June 3d. Shortened the pendulum of the clock, by putting round the index of the bob, one degree or division.

June 5th. Equal altitudes of the sun's lower limb.

| | A. M. | Double altitude | | P. M. | | |
|---|---|---|---|---|---|---|
| | h ′ ″ | ° | | h ′ ″ | | |
| At | 8 38 7½ | 89 | at | 3 19 1½ | Index on | 17′ 35″ |
| | 42 48½ | 91 | | 14 19¼ | off | 45 33 |
| | 45 9 | 92 | | 11 58½ | | |
| | 47 30 | 93 | | 9 39 | | |
| | 49 50½ | 94 | | 7 17¼ | | |
| | 52 11½ | 95 | | 4 56¾ | | |
| | 54 32½ | 96 | | 2 36½ | | |

By these the clock was too fast for mean time. . . . . . . 34″ 11

June 9th. Equal altitudes of the sun's lower limb.

| | A. M. | Double altitude | | P. M. | | |
|---|---|---|---|---|---|---|
| | h ′ ″ | ° | | h ′ ″ | | |
| At | 8 59 13 | 98 | at | 2 59 18¾ | Index on | 17′ 50″ |
| | 9 1 33½ | 99 | | 56 57½ | off | 45 10 |
| | 3 54 | 100 | | 54 36½ | | |
| | 6 15½ | 101 | | 52 16 | | |

By these the clock was fast for mean time. . . . . . 32″ 75

☿ June 11th, astronomical time, with the reflector, power 100, observed an immersion of Jupiter's 1st satellite at $11^h$ 18 $16\frac{1}{2}''$ per clock: clouds were passing, and a thin vapour overspread the disk of Jupiter; it is conjectured that the true time of the immersion might have been 10 or 15 seconds later.

June 12th. Equal altitudes of the sun's lower limb.

| | A. M. | | | Double altitude | | P. M. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h | ′ | ″ | ° | | h | ′ | ″ | | | | |
| At | 9 | 8 | 47 | 102 | at | 2 | 50 | 52 | 4 | Index on | 18′ | 22″ |
| | | 11 | 7½ | 103 | | | 48 | 32 | | off | 44 | 46 |

By these the clock was fast for mean time 31″ 58, and by a comparison with those of the 5th and 9th, the clock loses at the rate of 0″ 368 per day, which correction being applied to the time per clock, of the immersion of Jupiter's 1st satellite, we shall have for the moment of the immersion, $11^h$ 17′ 44″ 644 mean time. The longitude deduced from this observation would be $6^h$ 5′ 41″ 4, or 91° 25′ 21″ West of Greenwich.

☉ June 15th, astronomical time. Prepared to observe the eclipse of the sun, which (from calculation) was expected to begin soon after $20^h$; at $19^h$ got the telescopes prepared: found a great undulation upon the limb of the sun, seen through the six-feet reflector; the red colour of the image was offensive to the eye; I therefore gave the preference to the fine mild yellow image (most perfectly defined) of a $2\frac{1}{2}$ feet achromatic telescope, belonging to a set of astronomical circles, although the power did not exceed 40.

The moment of the expected impression approached, and reflecting that this eclipse was to be seen all over Europe and North America, which renders it a very important phenomenon for settling comparative longitudes, I conceived that all the zealous astronomers of both worlds were then looking with me at the great luminary and centre of our system: I kept my eye riveted upon that point of the disk where the eclipse was to commence, with an anxiety known only to astronomers; with the chronometer watch at my ear, I attended to the most doubtful appearances which my perturbation perhaps presented to the eye, and upon every alarm, began to count the beats of the watch, (five in two seconds) in order that I might not lose the very first instant of the impression, and I am confident that not one quarter of a second was lost, of the time when the impression was visible by my telescope. Dr. Maskelyne seems to be of opinion, that five seconds ought to be allowed for the time elapsed from the first contact until the impression becomes visible in our telescopes. The atmosphere was remarkably fine and serene during the whole time of the eclipse, although the weather was extremely unfavourable for many days both before and after. The limb of the sun was well defined, by a fine circular line, but that of the moon was irregularly indented, more particularly when seen by the reflector with a power of 200.

The result is as follows.

| | h | ′ | ″ |
|---|---|---|---|
| Visible commencement of the eclipse per clock, at | 20 | 5 | 59 |
| Dr. Maskelyne's correction. | | — | 5 |
| True commencement per clock | 20 | 5 | 54 |
| End of the eclipse per clock. | 22 | 39 | 24 |

June 18th. Equal altitudes of the sun's lower limb.

| | A. M. h ′ ″ | Double altitude ° | | P. M. h ′ ″ | | ′ ″ |
|---|---|---|---|---|---|---|
| At | 8 48 23 | 93 | at | 3 13 40¾ | Index on | 17 10 |
| | 50 43¾ | 94 | | 11 19 | off | 45 50 |
| | 53 5 | 95 | | 8 58 | | |
| | 55 26½ | 96 | | 6 37½ | | |
| | 57 47½ | 97 | | 4 17 | | |
| | 9 0 7 | 98 | | 1 56 | | |

By these the clock was fast for mean time 28″ 19, and by a comparison with those of the 12th, the clock loses at the rate of 0″ 565 per day, which correction being applied to the observed times of the eclipse per clock, the true results will be as follows.

| On the astronomical 15th of June. | Mean time. | Apparent time. |
|---|---|---|
| Beginning of the eclipse at. | 20h 5′ 24″ 6 | 20h 5′ 19″ |
| End of the eclipse. | 22 38 54 67 | 22 38 47 72 |

July 5th. Equal altitudes of the sun's lower limb.

| | A. M. h ′ ″ | Double altitude ° | | P. M. h ′ ″ | |
|---|---|---|---|---|---|
| At | 8 57 26 | 95 | at | 3 11 14½ | Index error of the |
| | 59 47 | 96 | | 8 54 | morning. 13′ 15″ |
| | 9 2 7 | 97 | | 6 33 | Index error of the |
| | 4 28 | 98 | | 4 12 | evening. 13′ 30″ |
| | 6 47 | 99 | | 1 50½ | |
| | 9 9¾ | 100 | | cloudy | |
| | 11 30½ | 101 | | 2 57 9½ | |
| | 13 50½ | 102 | | 54 48½ | |

By these the clock was fast for mean time 19″ 85, and by a comparison with those of the 18th, the clock loses at the rate of 0″ 49 per day.

On the evening of the same day ♄ the astronomical 5th, with the reflecting telescope, power 100, observed an emersion of Jupiter's 2d satellite at $9^h\ 44'\ 42''$ per clock; the above correction being applied, we shall have for the moment of the visible emersion, $9^h\ 44'\ 22''\ 35$, mean time. Clouds were passing and a vapour obscured, in some degree, the disk of the planet, similar to that of the 11th of June, though rather more dense, and it is thought probable, that the emersion was seen too late by 20 or 30 seconds: the longitude deduced without correction would be $6^h\ 5'\ 0''$ west of Greenwich.

☉ July 6th, astronomical time, observed with the reflector, power 100, an emersion of Jupiter's first satellite, at $8^h\ 12'\ 24''$ per clock, and the correction for the rate of the clock being applied, the visible emersion took place at $8^h\ 12'\ 4''\ 81$, mean time, the longitude deduced would be $6^h\ 5'\ 12''\ 19$.—Now as the density of the vapour of this evening and that of the 11th of June are supposed to be equal, and that the one observation was an immersion and the other an emersion of the same satellite, the imperfection of vision caused by the vapour or by the great and strong light of the planet, so near to the points of observation, would produce errors in contrary directions, the one advancing, the other retarding the moment of visible contact, a mean of the two results will therefore probably be near the truth.

| | | | | |
|---|---|---|---|---|
| Result of the immersion of the 11th of June. . . . . . | $6^h$ | $5'$ | $41''$ | 4 |
| Result of the emersion of the 6th of July. . . . . . . | 6 | 5 | 12 | 19 |
| Mean longitude. . . . . . . . . . . . . | 6 | 5 | 26 | 8 |

## No. XLIII.

*Observations of the eclipse of the sun, June 16th, 1806, made at Kinderhook, in the State of New-York, by Jose Joaquin de Ferrer.*

Read August 15th, 1806.

ACCORDING to the latitudes and longitudes of the moon inserted in the French connoissance de temps, the conjunction